National Park Service
U.S. Geological Survey
U.S. Department of the Interior

Response to Coral Bleaching in U.S. Virgin Islands National Parks

A major increase in sea temperatures led to unprecedented bleaching of corals in 2005 in the Eastern Caribbean including the U.S. Virgin Islands where national parks were particularly hard hit.

Bleached corals within Virgin Islands National Park.

What is Coral Bleaching?

Environmental stress can cause corals to lose symbiotic algae *(zooxanthellae)* that live inside their tissue, which leaves the tissue transparent and reveals the white coral skeleton underneath. This potentially fatal reaction gives the coral a "bleached" appearance.

Initial Assessment of Bleaching and Disease

The National Park Service (NPS) and U.S. Geological Survey (USGS) intensified coral monitoring as soon as water temperatures began to rise in early September 2005 to assess the scale and impact of bleaching on coral reefs in the National Parks. An average of 90% of coral cover bleached at six long-term monitoring sites at Virgin Islands National Park on St. John and Buck Island Reef National Monument on St. Croix. Many corals began to recover from bleaching and then suffered a "one-two punch" when they were afflicted by disease. Greater than 40% loss of live coral cover occurred at Tektite Reef and more than 20% at Haulover Reef on St. John. Of the over 460 elkhorn colonies that are being monitored at four reefs in Virgin Islands National Park by scientists from USGS, NPS and the University of the Virgin Islands, about 45% bleached, 13% died partially, and 8% died completely. This bleaching and disease episode highlights the importance of reducing stresses on coral reefs and enhancing their resilience to future bleaching events.

NPS/USGS Coral Monitoring Programs in the Parks

The NPS South Florida/Caribbean Inventory and Monitoring Network Program (NPS-SFCN) has 120 video transects grouped into six study sites around Virgin Islands National Park in St. John and Buck Island Reef National Monument off St. Croix, US Virgin Islands. Repeat digital video recordings of coral colonies provide an extensive visual record, which is analyzed to track changes including bleaching and diseases. Established in 1999, this program enables the Park Service to statistically quantify changes in coral cover and condition of reefs with high coral abundance and habitat complexity. USGS Caribbean Field Station is monitoring 460 Elkhorn coral (*A. palmata*) colonies for bleaching and diseases in four zones around St. John each month. All of the NPS-SFCN and USGS sites are geo-referenced and have underwater temperature data loggers, collecting data every two hours. Biologists at Buck Island Reef National Monument on St. Croix conduct long term coral monitoring at numerous sites within the park, and initiated additional site surveys in response to bleaching in 2005.

Impacts of Bleaching and Disease

The 2005 bleaching episode is the most severe ever recorded in the U.S. Virgin Islands. An average of 90% of coral cover bleached at the six NPS-SFCN study sites. This bleaching episode was followed immediately by a severe outbreak of coral disease that affected primarily the major reef building species (e.g., brain and star corals). Together with scientists from the USGS Caribbean Field Station, NPS-SFCN collected additional data to quantify coral mortality from a severe outbreak of coral disease that followed

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the bleaching episode. Measurements of disease mortality were taken along with tissue samples for microbial analysis. Assessment results from two study sites are available and reveal greater than 40% loss of live coral cover at Tektite Reef and more than 20% loss at Haulover Reef. Extensive disease mortality has been observed at depths ranging from 10–100 feet.

Losses Affecting Elkhorn Coral *(Acropora palmata)*

Of the over 460 elkhorn colonies that are being monitored at four reefs in Virgin Islands National Park by scientists with USGS, NPS and the University of the Virgin Islands, about 45% bleached, 13% died partially, and 8% died completely. However, white pox and other unidentified diseases have caused greater losses than bleaching at two of these sites. Bleaching of elkhorn was more severe within Buck Island Reef National Monument than on reefs around St. John. Elkhorn coral (*Acropora palmata*) once defined and dominated shallow Caribbean coral reefs. With its complex branching morphology and large size, Elkhorn coral reefs provide habitat for fishes and many other organisms including endangered hawksbill sea turtles. It is now being proposed for listing as threatened under the Endangered Species Act because of extensive losses from disease and hurricanes in the 1970s and 1980s. In the last 15 years, new elkhorn colonies have begun to grow on many Caribbean reefs, including within Virgin Islands National Park, Virgin Islands Coral Reef National Monument, and Buck Island Reef National Monument. However, disease and physical damage from natural and human causes are limiting its recovery. During the recent bleaching episode, elkhorn coral bleached for the first time on record in the US Virgin Islands, which led directly to the death of many colonies.

Implications for Resource Managers

This event exemplifies how the delicate ecological balance of coral reefs can so easily be disrupted. Coral reef ecosystems are deteriorating from stresses such as sustained, higher sea temperatures, pollution, fishing, and physical damage. Management actions to improve water quality, prevent over-fishing, physical damage and overuse, and minimize reef degradation will reduce stresses on coral reefs and create a foundation for ensuring their recovery and long-term survival. Parks could serve as "replenishment reserves" by protecting resilient corals and helping coral reefs endure future bleaching events and other stressors.

Future Monitoring and Research

Scientists are beginning to frame questions about the variability in how corals respond to bleaching and disease. USGS plans to investigate these patterns by looking at genotypes of the host corals and the types ("clades") of zooxanthellae found in corals that either resist or succumb to bleaching, using a recently developed swab sampling technique that does not harm the coral colony. Research may identify types of corals that could be more resistant than others to bleaching and disease. USGS and NPS are particularly concerned about incidence of disease occurring around this bleaching event and the correlations between disease outbreaks, bleaching, and water temperatures. In addition, NPS and USGS are working closely with the National Oceanic and Atmospheric Administration (NOAA) on biogeographic assessments of coral reefs, including bleaching and recovery.

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Ten national parks are working to conserve valuable coral reef resources. In 2005, the National Oceanic and Atmospheric Administration proposed both elkhorn (shown here bleached on the left and healthy on the right) and staghorn coral for listing as threatened under the Endangered Species Act.